UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Inspection Date(s): 9/18/2017 – 9/21/2017

Regulatory Program(s): SIP, NSPS

Company name: Antero Resources

Facility Name: Hamilton, Estlack, Weigle East, Eddy, Primm, Robert Williams, Fritz, Lockhart Heirs, Charlene, Walnut West, Diane Davis, Ness, John Richards, Edwin, Mackay, and Rock Run well pads

Facility Physical Locations: West Union, Alma, Middlebourne, Pennsboro, and Pullman, West Virginia. See attachment 1 for details.

Mailing Address: 535 White Oaks Blvd, Bridgeport, WV 26330

County/Parish: Tyler, Ritchie and Doddridge

Facility Contact: Lou Ann Lee, Air Program Field Coordinator
llee@anteroresources.com, 304-842-4479

AFS Number: 54-1700078, et. Al. See attachment 1 for details.

NAICS: 211113 - Conventional Oil and Gas Extraction

SIC: 1311: Crude Petroleum and Natural Gas

Attendees:
Facility Representatives:

Lou Ann Lee, Air Program Field Coordinator, 304-842-4479
Michael Gray, Production Maintenance Supervisor, 304-842-4920
Alicia Rafuse, Environmental Field Specialist II, 304-842-4055
Nick Summerfield, Environmental Field Tech, 304-842-4721
Chris Harman, Production Field Safety Supervisor, 304-677-0158
John Warren, Production Field Safety Supervisor, 724-988-6300
Randy Kloberdanz, Environmental and Regulatory Director

EPA Inspectors:

Cary Secrest, USEPA Headquarters, 202-564-8661
Jim Adamiec, USEPA Region III, 215-814-2175

EPA Lead Inspector Signature/Date	Cary Secrest 11-14-17	
	Cary Secrest	**Date**
EPA Inspector Signature/Date	J Adamiec 1-9-18	
	Jim Adamiec	**Date**
Supervisor Signature/Date	1/11/18	
	Zelma Maldonado	**Date**

I. Introduction

The United States Environmental Protection Agency (EPA) visited several Antero Resources (Antero) wellpads to verify compliance with permitting requirements and applicable State and Federal regulations. On September 12, 2017, the EPA notified Barry Schatz, of Antero, by phone and email that the CAA inspection would commence on September 18, 2017. In a later email, Antero notified EPA that Lou Ann Lee would be the point of contact.

A. Summary of the Facility-

EPA visited 16 wellpads owned, drilled and operated by Antero. The names of the sites are Hamiliton, Estlack, Weigle East, Eddy, Primm, Robert Williams, Fritz, Lochart Heirs, Charlene, Walnut West, Diane Davis, Ness, John Richards, Edwin, Mackay, and Rock Run. The wellpads are located in Doddridge, Tyler, and Ritchie counties. These sites were chosen for inspection because they are the Antero sites which produce the largest amount of natural gas liquids; producing between 20,000 to 130,000 barrels of condensate per year. The wells located at the sites are horizontally drilled wells that have been hydraulically fractured to extract natural gas from the Marcellus Shale formation. The sites were drilled and completed after August 23, 2011 and are therefore subject to either NSPS OOOO or NSPS OOOOa (40 C.F.R. Part 60 Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced After August 23, 2011 and on or Before September 18, 2015 or 40 C.F.R. Part 60 Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced After September 18, 2015).

All 16 visited sites are considered minor sources. Each site has either a minor source permit or a general permit G70 for natural gas production facilities (both under 45CSR13).

The general permit G70-C establishes the following maximum annual emission limits:

Pollutant	Maximum Annual Emission Limit (tpy)
Nitrogen oxides	50
Carbon monoxide	80
Volatile organic compounds	80
Particulate matter	20
Sulfur Dioxide	20
Any single Hazardous air pollutant	8
Total Hazardous air pollutant	20

B. Inspection Opening Conference-

EPA met with Antero representatives at 9:00 am on September 18, 2017. Cary Secrest (EPA Headquarters), and Jim Adamiec (Region III) represented EPA. Present from the facility were Lou Ann Lee, Michael Gray, Alicia Rafuse, Nick Summerfield, and John Warren. The West Virginia Department of Environmental Protection was notified of the inspection; however, they were not able to attend. EPA presented their credentials and informed Antero that the purpose of the inspection was to assess compliance with the applicable regulations at the well pads. EPA informed Antero it would be taking photographs and videos with a digital camera and an optical gas imagining camera (FLIR GF320). Antero was informed of their right to claim any photo, video, or document as Confidential Business Information (CBI). Antero did not claim anything as CBI during the inspection. Following a safety briefing, EPA and Antero representatives drove together to the various well pads.

II. Process Overview

The 16 sites visited by EPA each have multiple horizontally drilled wells that produce natural gas, condensate and (produced) water. Each site has gas processing units, condensate storage tanks, produced water storage tanks, one or more enclosed combustors, and well heads. Some of the sites are equipped with vapor recovery units (VRU) and/or vapor recovery towers. Although Antero refers to them as VRUs these units do not recirculate any of the gas and instead function as a pump and compressor unit. The gas leaves the site via pipeline. The pipeline is equipped with a sale meter to record flow and a slug catcher to remove liquids.

As gas rises from the well it is a mixture of water, gas, and oil. The gas processing units (GPU) separate these materials into different components. The gas mixture enters the GPU and strikes a plate, causing some of the liquids to drop out as a water condensate mixture. Meanwhile, the gas rises and travels past the plate. The water/condensate mixture remains at the bottom of the drum. The condensate rises to the top of the water/condensate mix and overflows into a secondary tank where it is then routed to condensate storage tanks. The produced water is also sent to storage tanks. A VRU pulls the gas from the GPU and sends it to the pipeline for sale and transportation. Tank emissions from either working, breathing or flashing losses are routed to a header that is then routed to an enclosed combustor for destruction. The enclosed combustors only control emissions off the tanks.

At the majority of its wellpads, Antero uses Cimarron Energy, Inc. model ECD-3-48HV-90, natural draft enclosed combustors. If there are multiple enclosed combustors operating, flow from the tanks is routed evenly to each enclosed combustor through a header. Ms. Lee explained

that the number of combustors used was determined based on initial production of each well. Operating parameters such as temperature and flame presence are monitored and stored in a central database.

Ms. Lee further explained that Antero uses a standard operating procedure in line with NSPS OOOOa (Standards of Performance for New Stationary Sources, Subpart OOOOa, Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced After September 18, 2015). Their procedure requires quarterly leak monitoring with an optical gas imaging camera.

III. Plant Tour / Walkthrough

At each site, EPA obtained photographs and recorded a FLIR video of the combustor(s) (see attachment 2: photolog). EPA also used the FLIR camera to observe tank hatches, wellheads, and GPUs at each site. On each operating enclosed combustor, a flame was observed through the sight glass, although at some wellpads the flame was pulsing. The pulsing could be described as the combustor flame having a fluctuating intensity; the flame would appear small before suddenly increasing and then dying back down again. Each increase in flame, or pulse, lasted only a second or two. As observed using the FLIR camera, uncombusted hydrocarbons were present at all but four of the enclosed combustors. EPA recorded FLIR videos of each enclosed combustor that appeared to have excess emissions.

Hamilton

Following the opening conference, EPA and facility representatives traveled together to the Hamilton wellpad (see attachment 1 for all wellpad addresses and coordinates), arriving at 10:08 am on September 18, 2017. Hamilton consisted of seven wellheads, seven GPUs, and seven storage tanks, plus two Cimarron enclosed combustors and one VRU. EPA observed the site using the FLIR camera and did not observe any excess emissions. The enclosed combustor plume, as viewed with the FLIR did not clearly show excess emissions. At 11:00 am EPA left Hamilton and proceeded to the next site.

Estlack

EPA arrived at the next site, Estlack wellpad, at 11:44 am. The site consisted of ten wells and GPUs, twelve tanks, three enclosed combustors, and five vapor recovery towers. The combustors appeared to show excess emissions when viewed with the FLIR camera. The combustors had the following characteristics:

Estlack Enclosed Combustors	
Unit ID	Operating Temperature (°F)
1378191	~250
1378189	~250
1378197	~250

At Estlack, EPA observed an emission from the GPU (MOV_0184) that appeared to be coming from an interior pneumatic controller. EPA also observed emissions (MOV_0185) coming from a VRU valve and regulator assembly. Antero maintenance personnel tightened the components and corrected the VRU emissions immediately. EPA departed the site and took a break for lunch at 12:58 pm.

Weigle East

EPA arrived at the Weigle East wellpad at 2:38 pm. This site contained three VRUs, six completed wells, eight wells under construction, thirteen GPUs, four enclosed combustors, and twelve storage tanks. EPA surveyed the equipment with the FLIR camera and found excess emissions at the enclosed combustor but no other equipment. The enclosed combustors had the following operating characteristics:

Weigle East Enclosed combustors	
Unit ID	Operating Temperature (°F)
1378143	269
1378144	262
1367703	152
1378118	195

EPA departed Weigle East at 3:43 pm.

Eddie

At 4:07 pm, EPA arrived at the Eddie wellpad. This pad has eight wellheads, eight GPUs, and eight tanks, plus one enclosed combustor, one VRU, and a lined, produced water lagoon. The lagoon stored water produced during the fracking. It was open to the air but covered with a net to keep birds out. EPA walked around the perimeter of the produced water pit and observed a slight hydrocarbon odor. EPA also used a photoionization detector around the perimeter and recorded <10ppb at all points. Using the FLIR camera, no excess emissions were detected from any tanks or other equipment at this site, however, the enclosed combustor, unit ID 1359740, appeared to have uncombusted emissions. The combustor was operating at 230°F. EPA left the Eddie wellpad and this concluded the inspections conducted on September 18, 2017.

Primm

The following day, September 19, 2017, the inspection resumed at 10:21 at the Primm Wellpad. This site has eight wells, eight storage tanks, and eight GPUs, and two enclosed combustors. EPA surveyed those components with the FLIR camera and found that there appeared to be excessive emissions from the enclosed combustors. Enclosed combustor ID numbers and operating temperatures are shown below:

Primm Enclosed combustors	
Unit ID	Operating Temperature (°F)
1378133	373
1363528	195

EPA left Primm at 10:57 pm and proceeded to the next wellpad, Robert Williams.

Robert Williams

At Robert Williams, emissions were observed at the top of tank 009-00003982. The tank contained produced brine water and condensates. Antero representatives repaired the leak by tightening a hammer union; no emissions were detected afterwards. No other equipment emissions were identified at this site in either the wellheads or GPUs. The enclosed combustor at Robert Williams, unit ID 12363526, was pulsing and EPA noted it was operating at 84°F. FLIR video of the combustor appeared to show excessive emissions. EPA left the site at 11:52 am.

Fritz

At 11:57 EPA arrived at the Fritz wellpad. Fritz consisted of eight wellheads, eight tanks, and eight GPUs, plus four enclosed combustors. FLIR video of the combustor appeared to show excessive emissions. No excess emissions were detected from any other equipment. The enclosed combustors were operating as follows:

Fritz Enclosed combustors	
Unit ID	Operating Temperature (°F)
1878165	350
1378153	376
1378101	296
1378160	159

EPA left Fritz at 12:24 pm.

Lockhart Heirs

EPA arrived at the Lockhart Heirs wellpad at 12:41 pm. Lockhart Heirs had two wells and GPUs, eight tanks, and one enclosed combustor. The enclosed combustor unit ID is 1359742 and it was observed to be pulsing and operating at 344°F. FLIR video of the combustor appeared to show excessive emissions. No excess emissions were detected at this site. EPA departed Lockhart Heirs at 1:07 pm.

Charlene

EPA arrived at the Charlene wellpad at 2:47 pm. Charlene has ten tanks, eight wells and eight GPUs, and three enclosed combustors, although one was not operating at the time of the inspection. The remaining two enclosed combustors had unit ID numbers of 1386204 and 1386205 and were operating at 476°F and 507°F and pulsing was observed through the sight glass of each enclosed combustor. FLIR video of the combustor appeared to show excessive

emissions while the GPUs, wellheads, and tanks appeared normal. EPA left the site at 3:22 pm and proceeded to the next wellpad.

Walnut West

EPA arrived at Walnut West at 3:33 pm. The site has four wellheads and GPUs, five tanks, and one enclosed combustor. Excess emissions were detected with the FLIR camera from the combustor. No other equipment at this site showed evidence of excess emissions. The enclosed combustor unit ID at Walnut West is 1359748 and the operating temperature was 206°F. EPA departed the site at 3:58 pm.

Diane Davis

EPA began to inspect the Diane Davis wellpad at 4:35 pm. The site contained five wells and GPUs plus six storage tanks and an enclosed combustor. The enclosed combustor unit ID at this site is 1363506 and it was operating at 204°F. FLIR video of the combustor appeared to show excessive emissions. At this site, no emissions were observed from any equipment except the flare. EPA concluded at this site at 5:00 pm and this marked the final inspection of September 19, 2017.

Ness

The following day, September 20, 2017 EPA met with facility representatives and traveled together to the Ness wellpad, arriving at 10:16 am. This wellpad contained five wellheads and GPUs, six storage tanks, and one enclosed combustor. The enclosed combustor unit ID is 1359736 with an operating temperature fluctuating between 278°F and 323°F. FLIR video of the combustor appeared to show excessive emissions. EPA timed a one-minute interval during which the enclosed combustor was pulsing approximately every five seconds. After that one-minute period, pulsing continued intermittently. EPA departed the site at 11:06 am.

John Richards

The next inspection began at 11:21 at John Richards wellpad. John Richards consisted of four wellheads, GPUs, and tanks, plus one enclosed combustor. No excess emissions were discovered with the FLIR camera in any process unit. The enclosed combustor unit ID was not recorded but it was operating at 545°F and appeared to be operating as designed. EPA left the site at 11:45 am.

Edwin

The next site was the Edwin wellpad. EPA arrived at 12:10 pm and noted the presence of nine wellheads and nine GPUS, eight tanks, and two enclosed combustors. The enclosed combustor unit IDs were 1378162 and 1378104 and were operating at 820°F and 846°F, both hotter than previously observed enclosed combustors. There were no excessive emissions observed with the FLIR and the combustor plume appeared smaller than it had at other sites. No other equipment showed signs of excess emissions at this site. EPA departed Edwin at 12:32 pm.

Mackay

The next wellpad was Mackay. EPA arrived at 2:29 pm and observed eight wells and GPUs, three vapor recovery units, three enclosed combustors, and twelve storage tanks. One area of

emissions was discovered on a vapor recovery unit and it was pointed out to Antero personnel. Of the three enclosed combustors, only one was operating: unit ID 1386215 with a temperature of 693°F. Observing the enclosed combustor with the FLIR camera did not reveal excess emissions and instead appeared to show a normal plume. EPA concluded the inspection of Mackay at 3:09 pm.

Rock Run

EPA arrived at Rock Run wellpad, at 3:36 pm. Rock Run was unique from the other sites in that it utilized not just one Cimarron enclosed combustor but also two additional Comm enclosed combustors. These were the only Comm enclosed combustors observed during the multiday inspection. The Comm enclosed combustors did not have a unit ID or serial number visible or readily available but their operating temperatures were recorded as 153°F and 351°F. The Cimarron enclosed combustor unit ID was 1378173 and it was operating at 353°F. The Cimarron flare appeared to be emitting excess emissions when viewed with the FLIR camera. The inspection concluded at approximately 4:15 pm.

IV. Records Review

EPA did not complete a records review during the inspection, however Antero did provide a document that detailed enclosed combustor design control efficiency data. This record was reviewed and discussed during the closing conference. Antero also provided a document entitled "Leak Detection and Repair (LDAR) Protocol, Antero Resources Production and Midstream Operations, West Virginia and Ohio,' and, "40 CFR Part 60, Subpart OOOOa Fugitive Emissions Monitoring Plan, Antero Resources Corporation, September 2016."

V. Closing Conference

The closeout meeting took place on the morning of September 21, 2017 in Bridgeport, WV. Present for this meeting was Cary Secrest (EPA) and Lou Ann Lee (Antero).

VI. Areas of Concern

During the closing conference, EPA noted that hydrocarbon plumes from enclosed combustors that were running at higher temperatures (~ 500°F– 700° F), as observed with the FLIR camera near the top of the stack, were smaller than those that were running at much lower temperatures. EPA indicated that the combustion efficiency of the enclosed combustors may need to be evaluated by Antero to ensure that they are operating as designed. EPA and Antero discussed the possibility that changes in liquid production over the life of the well could be a factor in enclosed combustor efficiency. Ms. Lee mentioned that she had already spoken with Mr. Barry Schatz of Antero's Denver, Colorado office, and that Antero is resolved to review the design and efficiency of all its 209 Cimarron enclosed combustors, and to contact Cimarron for advice.

EPA also noted that the inspection revealed one small excess emission at the Robert Williams wellpad storage tank that was repaired on site. Additional emissions from equipment was found on vapor recovery units at the Estlack and Mackay wellpads.

VII. List of Attachments

1. Table showing wellpad names, inspection dates, and locations
2. Photo Log and photos
3. Video Log
4. EPA Compliance Alert

ATTACHMENT 1: Table showing wellpad names, inspection dates, and locations

Antero Wellpads					
Wellpad Name	**AFS Number**	**Inspection Date**	**Address**	**Coordinates**	
Hamilton	54-1700078	9/18/2017	20 Knights Fork Rd, West Union, WV 26456	39.36772	-80.7437
Estlack	54-9500057	9/18/2017	2288 Purgatory Rd, Alma, WV 26320	39.41371	-80.8778
Weigle East	54-9500045	9/18/2017	441 Lemasters Rd, Middlebourne, WV 26149	39.4662	-80.8528
Eddy	54-8500030	9/18/2017	4728 Mountain Dr, Pennsboro, WV 26415	39.33392	-80.9201
Primm	54-1700091	9/19/2017	1313 Oxford Rd, West Union, WV 26456	39.24142	-80.8527
Robert Williams	54-1700099	9/19/2017	20 Cabin Run Rd, West Union, WV 26456	39.2377	-80.8627
Fritz	54-1700107	9/19/2017	201 Elliot Rd, West Union, WV 26456	39.23416	-80.8401
Lockhart Heirs	54-8500031	9/19/2017	94 Holbrook Rd, Pullman, WV 26421	39.191	-80.8904
Charlene	54-8500036	9/19/2017	60 Gnats Run, Pennsboro, WV 26415	39.29972	-80.9638
Walnut West	54-8500038	9/19/2017	1758 Beech Grove Rd, Pennsboro, WV 26415	39.31311	-80.9982
Diane Davis	54-1700103	9/19/2017	2899 Sam Cavins Rd, West Union, WV 26456	39.30396	-80.8229
Ness	54-8500032	9/20/2017	3237 Oxford Rd, Pullman, WV 26421	39.19539	-80.9012
John Richards	54-8500037	9/20/2017	5513 Lynn Camp Rd, Pennsboro, WV 26415	39.20545	-80.9196
Edwin	54-8500034	9/20/2017	2720 White Oak Rd, Pennsboro, WV 26415	39.23035	-80.903
Mackay	unassigned	9/20/2017	2177 Leeson Run, Pennsboro, WV 26415	39.23833	-80.8971
Rock Run	54-1700108	9/20/2017	794 Tunnel Hill Rd, West Union, WV 26456	39.30496	-80.8147

ATTACHMENT 2: Photo Log and Photos

DSC00523	Hamiliton Entrance Sign
DSC00524	Hamilton Wells
DSC00525	Hamilton GPU
DSC00526	Hamilton VRU
DSC00527	Hamilton Sale Meters and Slug Catcher
DSC00528	Estlack Entrance Sign
DSC00529	Estlack Entrance Sign with Well Names
DSC00530	Estlack Storage Tanks and Vapor Recovery Tower
DSC00531	Estlack Flares
DSC00532	Estlack Flare ID Plate
DSC00533	Estlack Site Overview
DSC00534	Weigle East Entrance Sign
DSC00535	Weigle East Entrance Sign
DSC00536	Eddy Entrance Sign
DSC00537	Eddy Produced Water Pond
DSC00538	Primm Entrance Sign
DSC00539	Primm Flare and Vent Gas Inlet
DSC00540	Robert Williams Entrance Sign
DSC00541	Robert Williams Tank
DSC00542	Fritz Entrance Sign
DSC00543	Fritz Entrance Sign
DSC00544	Lockhart Heirs Entrance Sign
DSC00545	Charlene Entrance Sign
DSC00546	Charlene Entrance Sign
DSC00547	Walnut West Entrance Sign
DSC00548	Diane Davis Entrance Sign
DSC00549	Ness Entrance Sign
DSC00550	John Richards Entrance Sign
DSC00551	Edwin Entrance Sign
DSC00552	Mackay Entrance Sign
DSC00553	Mackay Entrance Sign
DSC00554	Rock Run Entrance Sign

DSC00523 Hamiliton Entrance Sign

DSC00524 Hamilton Wells

DSC00525 Hamilton GPU

DSC00526 Hamilton VRU

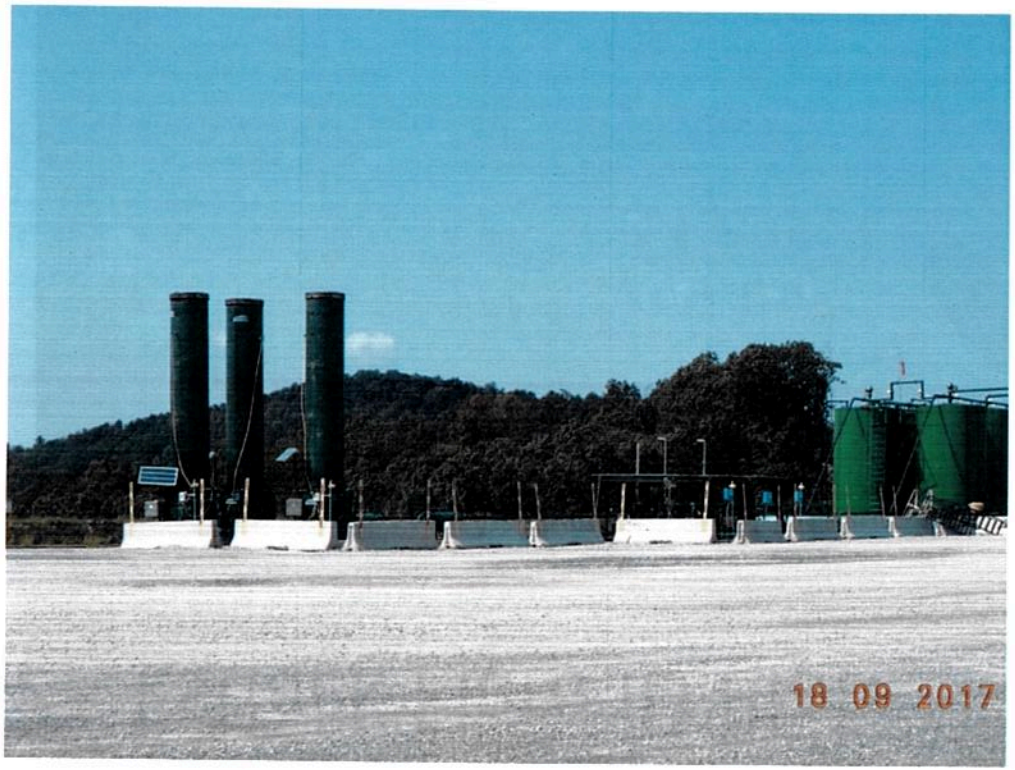
DSC00527 Hamilton Sale Meters and Slug Catcher

DSC00528 Estlack Entrance Sign

DSC00529 Estlack Entrance Sign with Well Names

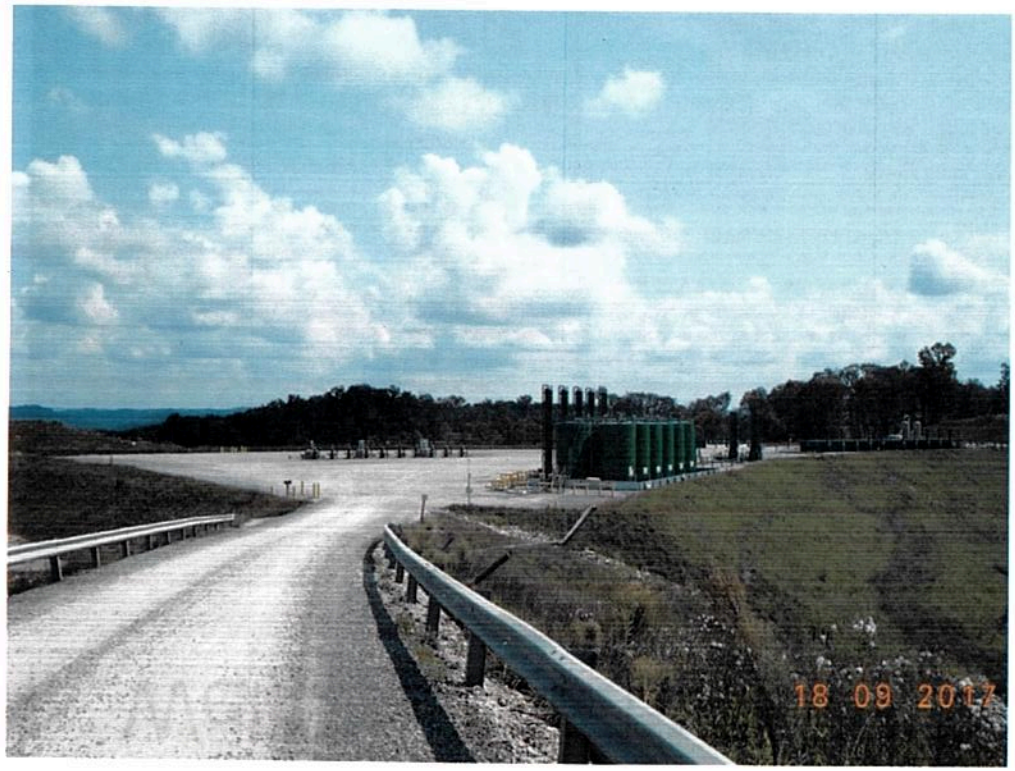
DSC00530 Estlack Storage Tanks and Vapor Recovery Tower

DSC00531 Estlack Flares



DSC00532 Estlack Flare ID Plate

DSC00533 Estlack Site Overview

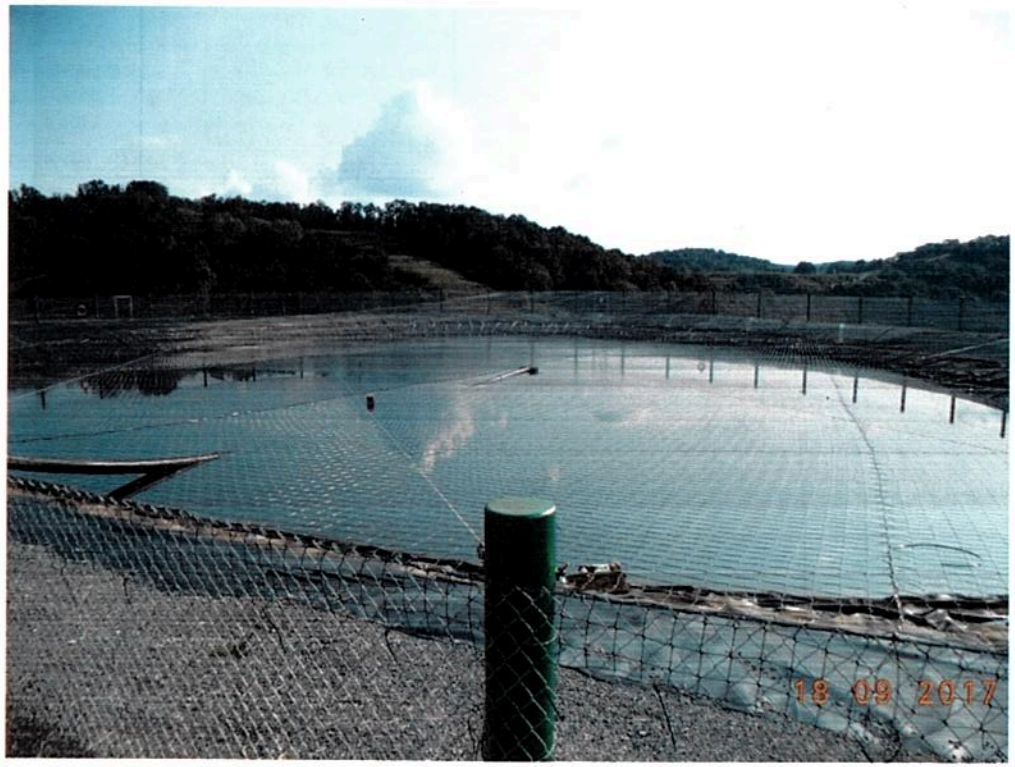


DSC00534 Weigle East Entrance Sign

DSC00535 Weigle East Entrance Sign

DSC00536 Eddy Entrance Sign

DSC00537 Eddy Produced Water Pond



DSC00538 Primm Entrance Sign

DSC00539 Primm Flare and Vent Gas Inlet

DSC00540 Robert Williams Entrance Sign

DSC00541 Robert Williams Tank

DSC00542 Fritz Entrance Sign

DSC00543 Fritz Entrance Sign

DSC00544 Lockhart Heirs Entrance Sign

DSC00545 Charlene Entrance Sign

DSC00546 Charlene Entrance Sign

DSC00547 Walnut West Entrance Sign

DSC00548 Diane Davis Entrance Sign

DSC00549 Ness Entrance Sign

DSC00550 John Richards Entrance Sign

DSC00551 Edwin Entrance Sign

DSC00552 Mackay Entrance Sign

DSC00553 Mackay Entrance Sign

DSC00554 Rock Run Entrance Sign

ATTACHMENT 3: Video Log

MOV0181	Hamilton Flare
MOV0182	Estlack Flare
MOV0183	Estlack Flare
MOV0184	Estlack GPU Enclosure Vent
MOV0185	Estlack VRU Valve
MOV0188	Weigle East Flare
MOV0189	Eddy Flare
MOV0190	Eddy Flare
MOV0191	Primm Flare
MOV0192	Primm Flare
MOV0193	Robert Williams Tank
MOV0194	Robert Williams Flare
MOV0195	Robert Williams Flare
MOV0196	Fritz Flare
MOV0197	Lockhart Heirs Flare
MOV0198	Lockhart Heirs Flare
MOV0199	Charlene Flare
MOV0200	Charlene Flare
MOV0201	Walnut West Flare
MOV0202	Walnut West Flare
MOV0203	Diane Davis Flare
MOV0204	Diane Davies Flare
MOV0205	Ness Flare
MOV0206	Ness Flare
MOV0207	Ness Flare
MOV0208	Ness Flare
MOV0209	John Richards Flare
MOV0210	Edwin Flare
MOV0211	Mackay Flare
MOV0212	Rock Run Flare